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SIZE-RESOLVED CCN COMPOSITION IN CUMULUS HUMILIS

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ABSTRACT

The Cumulus Humilis Aerosol Processing Study (CHAPS) provided a unique opportunity to study cloud processing of aerosols. Clouds play an active role in the processing and cycling of atmospheric constituents. Within in a cloud, gases and particles can partition to cloud droplets by absorption and condensation as well as activation and impact scavenging. The Department of Energy (DOE) G-1 aircraft was used as one of the main platforms in CHAPS. G-1 flight tracks were designed to characterize aerosols at cloud top and cloud base as well as within individual cumulus humilis (or fair-weather cumulus) in the vicinity of Oklahoma City. Measurements of interstitial aerosols and residuals of activated condensation cloud nuclei were conducted simultaneously. The interstitial aerosols were measured downstream of an isokinetic inlet and the activated particles downstream of a counter-flow virtual impactor (CVI). The sampling line to the Aerodyne Aerosol Mass Spectrometer (AMS) was switched between the isokinetic inlet and the CVI to allow characterization of non-activated particles outside of clouds in contrast to particles activated in clouds. Trace gases including ozone, carbon monoxide, sulfur dioxide, and a series of volatile organic compounds (VOCs) were measured. Key meteorological state parameters included liquid water content, cloud drop size, and dew point. In this presentation, we will focus on case studies of CCN properties in cumulus humilis. The first analysis summarizes three case studies of measurements made at cloud bottom and in-cloud by the AMS. The size-resolved composition is different between background and activated particles. The second analysis links in situ measurements of aerosol, trace gas, and VOCs to look into the sources of CCN. For instance, by comparing the characteristic m/z ratios by AMS and tracers like CO or isoprene, one can gain more insight into the role of primary and secondary organic aerosols in CCN and background aerosols. The third analysis will use a recently developed method to bin data collected within the cumulus humilis to study the correlation between CCN composition and cloud properties. The presentation will provide an improved picture of CCN in cumulus humilis.